The Determinants of Latin American Exchange Rate Regimes

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ABSTRACT

The experience of the last thirty years suggests that a wide range of factors affects policymakers' choice of exchange rate regime. The initial explanation was that changes in the international sphere dominated domestic policies and strongly influenced how governments decided among the trade-offs. More recently, domestic political factors' influence on the choice of exchange rate regimes have been emphasized, providing detailed and rich insights into the dynamics of the choice. Neither approach has been entirely successful. Both internal and external factors must be taken into account. This article builds on previous empirical work and takes into account domestic and international influences on the choice of exchange rate regimes in Latin America between 1964 and 1996. In, addition, we highlight a variety of "interactions," choices of economic policy that are affected by both national and international pressures and that, in turn, influence the choice of exchange rate regime. The empirical model uses multinomial ordered logit analysis to determine the factors in exchange rate determination and to compare the explanatory of the models with and without the interaction variables.

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I. Introduction

The linkages among the international financial system, a country's exchange rate regime, and its domestic real and financial sectors are quite complex and dynamic, challenging our simple models and conventional understanding. In addition, the demise of the Bretton Woods system of fixed exchange rates has moved the exchange rate regime to the center of Latin American governments' macroeconomic challenge. The lesson of the 1970's was that fixed exchange rates and macro stability could be attained, as long as countries had access to ample international capital flows. In the 1980s, policy-makers confronted the disappearance of international saving while they attempted to maintain fixed exchange rates, an effort that was only sporadically successful. Finally, the 1990s saw a wide variety of exchange rate regimes and illustrated that all regimes were consistent with improved macro performance if combined with international capital flows. On the other hand, managed exchange rates were more subject to destabilizing fluctuations. This led to a short-lived "bi-polar" consensus that either a floating or a hard-peg regime was the road to international stability (Fischer 2001). Even before Argentina abandoned convertibility in 2002, that conclusion had come into question, leaving no simple conclusion to the debate.

The experience of the last thirty years suggests that a wide range of factors affects policymakers' choice of exchange rate regime, though different regimes are associated with particular economic performance. The initial explanation was that changes in the international sphere dominated domestic policies and strongly influenced how governments decided among the trade-offs (Frieden and Rogowski 1996). More recently, domestic political factors' influence on the choice of exchange rate regimes have been emphasized, providing detailed and rich insights into the dynamics of the choice (Frieden and Stein 2001; Wise and Roett 2000).

Neither approach has been entirely successful. The regime choice is so important and influenced by such a range of factors that both internal and external factors must be taken into account. This article builds on previous empirical work (Frieden, Ghezzi, and Stein 2000) and takes into account domestic and international influences on the choice of exchange rate regimes in Latin America between 1964 and 1996. In, addition, we highlight a variety of "interactions," choices of economic policy that are affected by both national and international pressures and that, in turn, influence the choice of exchange rate regime.

While the study is retrospective of its very nature, the failure to find any one acceptable exchange rate regime during the last decade increases its relevance for countries that continue to face the problem of finding a viable exchange rate regime. Argentina's abandonment of convertibility, Ecuador's dollarization, Guatemala's move in that direction, and Uruguay's forced depreciation all highlight the contemporary centrality of this continuing issue. Thus the factors that affect countries' choices continue to be of central interest today and as we look to the coming years.

The next section summarizes the empirical work done to date and develops the theoretical basis for the addition of external and interaction variables to the empirical investigation. The following section specifies the complete model and presents the estimates obtained. The central approach follows closely the earlier empirical work of Frieden, Ghezzi and Stein (2001) and draws upon the same data set. We also use the work of Levy and Sturzenegger(1999) to assess the sensitivity of such empirical work to definitions of exchange rate regimes in Appendix I. The final section summarizes the conclusions obtained by including internal, and interaction/external variables in any study attempting to explain the choice of exchange rate regime.

II. The Empirical Model of Exchange Rate Regime Choice

Frieden, Ghezzi, and Stein (FGS) developed an empirical model to examine the domestic determinants of exchange rate regime choice. Their basic model used multinomial ordered logit analysis in order to quantify the effect of the determinant variables on the choice of the exchange rate regimes. (See Appendix III for a detailed explanation). The dependent variable, the exchange rate regime , had four different response levels:

0- Fixed (to single currency, basket, or infrequent adjustments)

1- Forward-looking crawls and bands

2- Floating (managed or independent)

3- Backward-looking crawl or band.

This was based upon a nine regime classification developed by Cottarelli and Giannini (1998) that expanded upon the five regime categories of the IMF. The floating exchange rate regime and backward-looking crawl were characterized as more competitive regimes, while fixed and forward-looking regimes were adopted to provide stability and credibility. The value of 0 for fixed exchange rate regime was used as a base variable against which all others were compared. So positive coefficient estimates for the independent variables implied that they increased the probability of adopting a more competitive exchange rate regime.

Fixed exchange rate regimes and forward-looking crawls and bands provide stability of exchange rates. They also have commonly been adopted as credible anti-inflationary tools by countries suffering from high inflation, since exchange rates serve as nominal anchors for the price level (Frieden et al., 2000). It follows that both of these regimes will tend to appreciate the home country's exchange rate at the expense of competitiveness. Floating regimes and

backward-looking crawls and bands, on the other hand, allow the home currency to depreciate in accordance with the international market forces, because under these regimes the central bank does not provide support for a target exchange rate. These are referred to as competitive regimes because they are often used to increase the international competitiveness of tradables. Historical data on Latin American economies show that fixed and forward-looking regimes have consistently produced appreciating real exchange rates, while floating and backward-looking regimes are associated with the most depreciated real exchange rates (FGS 2001). It is important to understand the properties of different exchange rate regimes to understand the underlying decision-making process in choosing a specific exchange rate regime.

There is a great deal of judgment involved in empirical specification of the dependent variable, both in choosing the categories and in placing observations into one category rather than another. Other authors in the Frieden and Stein (2001) volume made different choices, e.g. De Gregorio's chapter on Chile used five categories of exchange rate regime. Levy and Sturzenegger(1999)(LS) developed an empirical technique for determining the regime based on cluster analysis and found a very different categorization from that of the IMF, which is based on the regime declared by a government. Appendix I compares the FGS categorization with LS's and examines the sensitivity of the results to the different specifications. There were some differences in the results with the LS specification, but the general pattern did not alter.

We will follow the FGS judgments on exchange rate regime to facilitate comparison between their results with those obtained with a wider set of variables. We should also note that FGS carried out sensitivity analysis by reestimating the equations with different definitions of the dependent variable and for different periods, in order to provide justification for their judgments. The results were found to be robust to alternative specifications.

The FGS model specified a variety of independent variables as exchange rate regime determinants, grouped into five categories[1]:

- macroeconomic/external/structural: lagged log of inflation(Log Inflation); dummy variable for hyper inflation (Hyper), which takes the value of 1 if the inflation is greater than 1,000%; degree of openness (Open), the ratio of imports plus exports as a share of GDP; lagged reserve ratio (Res/M2); coefficient of variation of the terms of trade (TOT volatility); and last, capital controls dummy (CapCon), which takes the value of 1 if there were restrictions on the capital account.
- Institutional: only one institutional variable was included in the regressions, a central bank independence dummy variable (CBI) that took value of 1 if a country's central bank was independent.
- Interest groups: the three major interest group variables were manufacturing's share of the country's GDP (Manufl), mining's share of the country's GDP (Minl), and agriculture's share of the country's GDP (Agrl). All three were lagged one period.
- Political variables: political instability (Polins) took a value of 1 if a country experienced three or more government changes in the last five years, two or more government changes in the last three years, or if a country had a successful coup, in which case the value of 1 is applied to the year in which a coup occurred and one year afterwards; the share of government seats in the legislature (Govseats); the effective number of parties in the legislature (Effpart); an interaction variable (Efpart*Minority) capturing the interaction of the number of parties with a dummy variable (Minority) that took a value of 1when the share of government

seats in the legislature was greater than 50%; a dummy variable for dictatorship (Dict), which took the value of 1 in a year when a country was under dictatorship.

- Trade liberalization: low tariffs(Tariff), which took the value of 1 if the country's average tariff was lower than 20%; and an interaction dummy variable (Manufl*Low Tariff) of low tariffs and the manufacturing share of GDP.

This list of seventeen variables contained only one that was exogenously determined by the international system, the volatility of terms of trade. A time trend variable included without explanation was also likely to capture the external influence. It was significant in all their regressions. It probably captured the international consensus that increasingly favored flexible exchange rates, particularly during the 1990s. The importance of this variable suggests that a complete examination of the determinants of exchange rate regime should include external variables as well as international policy choices whose interaction with domestic policy would influence the choice of regime.

There were several such variables in the FGS model. The degree of openness, the reserve/M2, and the capital control variables are all policy variables that affect the position of the country in the international economy. The same is true of the tariff dummy. Choices in these areas are affected by both the international economy and by domestic political choices. Thus we term them interaction variables.

Let us now consider why these variables along with additional international variables should be included in any effort to develop a more complete empirical model of exchange rate determination, drawing primarily on the empirical studies in the Frieden and Stein volume.

III. Exchange Rate Regimes: International and Interaction Factors

Many of the individual country studies in the Frieden and Stein volume suggest the importance of international and interaction variables in the choice of regime. The history of exchange rate regimes in Latin America has not been moved solely by domestic nor by international factors. The determinants of the choice are in the combination of the two and their interaction, especially during the time period after the collapse of the Bretton Woods system in 1973. In addition, with increasing international pressures for liberalization of the Latin American economies, external factors have gained more importance as crucial determinants of a country's exchange rate regime. With economic liberalization and increased involvement with the IMF, current and capital account balances, as well as their restrictions, terms of trade, and foreign liabilities became essential external variables whose macroeconomic importance has increased significantly. The country studies included in Frieden and Stein (2001) provide ample support for this view.

An example of the importance of the external balance in exchange rate regime determination comes from Brazil's exchange rate regime history (Bonomo and Terra 2001). This study of the largest Latin American country's exchange rate regime history supports the importance of the external macroeconomic environment as a crucial exchange rate regime determinant. Brazil's exchange rate policy was guided primarily by balance of payments and inflation considerations. Here we see the interaction between an external and an internal factor, which supports the proposition that understanding the exchange rate regime requires consideration of external, internal, and interaction factors. Brazil is only one among many Latin American economies that owe a good part of their dynamic exchange rate regime experiences to external economic factors. Argentina's exchange rate policies have been influenced by such

external factors as: deterioration of the external account, external debt, and liberalization of the capital account (Diaz-Bonilla & Schamis, 2001). Unlike Brazil, where the balance of payments can be singled out as major influence in exchange rate regime determination, Argentina's exchange rate policy has been influenced by a combination of external factors.

Chile has had a number of exchange rate regime changes in response to external factors. In the case of Chile, the external environment, captured by the availability of international funds to finance current account deficits, along with the high amount of foreign liabilities were largely responsible for most changes in the exchange rate policies (De Gregorio, 2001).

Ecuador is another Latin American country that has had economic problems due to the rapid growth of its external debt. External debt grew from $600 million in 1973 to $16.4 billion in 1998, a growth that would pave the way for future macroeconomic instability and the inevitable change of exchange rate policies (Jameson, 2003). We can already see that the two variables that appear repeatedly are external account balance and foreign debt.

Finally, Peru resembled a number of other small and open Latin American economies that were vulnerable to the impact of external factors. Its exchange rate regime changes were particularly tied to changes in its terms of trade and fluctuations in international interest rates that produced numerous balance of payments crises (Pasco-Font and Ghezzi, 2001).

All of these examples reinforce the necessity of including external and interaction factors as important determinants of exchange rate regimes in the Latin American region, along with domestic factors.

IV. Exchange Rate Regimes: The Complete Model

As noted above, the data that will be used in the estimation are the same used in

FGS(24). They are panel data for 26 Latin American countries over the period 1960-1994. When missing values are taken into account, there are a maximum of 811 observations

Only one of the variables is external and exogenous to country decisions, the volatility of terms of trade. We will include a measure of terms of trade in our estimates as another external influence on choice of exchange rate regime.

One other set of variables in FGS captures the interaction of domestic policy and the international economy: the tariff level, the degree of openness, lagged reserve ratio, and the use of capital controls. Their values reflect domestic policy decisions, however they embody the international influence on exchange rates in two dimensions. First of all, they will affect the viability of any exchange rate regime that is chosen. Second, current international conventional wisdom has favored low tariffs, greater openness, high levels of reserves, and removal of capital controls to reassure international capital. As a result, these variables reflect an interaction of domestic policy choice and international influence. So they should be considered interaction variables in our wider evaluation of factors in exchange rate regime choice.

We add four other variables from the original data set of a similar nature: foreign liabilities (For Liab), current account restrictions (Curr Res), external account balance (Bal), and debt in major foreign currencies(Debt). Each of them is expected to influence policy toward fixed exchange rates. In addition, we add the terms of trade (ToT) as another internationally given variable.

Let us now examine in more detail the new variables and their expected effect on choice of exchange rate regime. The terms of trade variable is defined as the price of exports over the price of imports and adheres to the World Bank's definition. The terms of trade variable is

expected to have a negative coefficient, implying that the improvement in a country's terms of trade should facilitate maintaining or adopting an exchange rate regime designed to provide credibility, such as a fixed regime and forward-looking crawls and bands.

Sachs, (1985) associated success of the East Asian economies during the debt crisis of the early 1980s with the maintenance of weaker, more competitive, exchange rate regimes that depreciated home currencies and encouraged the production of exports. His conclusion followed from his argument that foreign capital inflows, ignited by the liberalization of a country's economy and used to facilitate production, would eventually have to result in exchange rate depreciation if debt is to be fully repaid. The logic is that depreciation of the domestic currency will increase foreign demand for domestic goods and boost the export revenues necessary to repay the foreign investment (Sachs, 1981). Sachs's argument implies that foreign liabilities should have a positive coefficient, suggesting that countries with greater foreign liabilities will be more likely to adopt a more competitive exchange rate regime, which will increase the probability of exchange rate depreciation. Following this argument, debt in major foreign currencies is also expected to have a positive coefficient. The current account restriction variable, which approaches the value of 1 if restrictions are present, is expected to have a negative coefficient. This implies that countries with current account restrictions will be more likely to choose a fixed exchange rate regime or forward-looking crawls and bands. These regimes, as previously noted, are associated with higher exchange rate appreciations; restrictions on the current account are one way to prevent the trade account from deteriorating under these circumstances. Under a more competitive exchange rate regime, the exchange rate will be more likely to depreciate, thereby decreasing the domestic demand for foreign goods and making

current account restrictions unnecessary.

Finally, the external account balance variable is expected to have a positive coefficient, suggesting that countries with increasing positive external balance can be expected to retain a competitive exchange rate regime. This variable is lagged one period in order to allow the time period needed for governments to react to changes in this account and to make causation clearer.

Appendix II presents the descriptive statistics for the external variables from 1960 to 1994 as well as values for the same variables for each of the four different regimes specified by FGS. The complexity of the relationship can be seen in these data. For example, few of the means increase or decrease linearly across regimes. The same is true for the variables used in the original study.

V. Results

The choice of the exchange regime is examined using the ordered multinomial logit model described in Appendix III. The dependent variable is defined as in the FGS model for the purpose of comparison, and the independent variables were described above.

The regressions in Table 1 explore the relationship between the choice of the exchange rate regime and only the new external variables. Columns 2-4 assess the sensitivity of the regressions to changes in definitions of the dependent variable and differences in time period.

(INSERT TABLE 1 ABOUT HERE)

Table 1 indicates that all the external/interaction variables except the external account balance are statistically significant. Each column of Table 1, with the exception of column two, where only observations after the Bretton Woods system collapse are included, represents regressions with slightly different definition of the dependent variable. The same sensitivity

analysis is used in Table 1 in order to test the robustness of external variables to changes in the definition of the dependent regime variable. The overwhelming majority of Latin American exchange rate regimes were fixed prior to the collapse of the Bretton Woods system, so column two is designed to see if coefficients for the external variables will change when those years are excluded. Because of the uncertainty in which group to put them, column three excludes the observations where the regime was fixed but with frequent adjustments. Column four reorders the response level values for fixed regime and forward-looking crawls and bands, because there are conflicting arguments on which of these regimes should be put on the extreme side of credibility-competitiveness spectrum. The estimated coefficients should be stable across the regressions.

The results indicate that the relationship is robust and that each of the variables is statistically significant, with the exception of the external account balance. The time trend is excluded from all of the estimates since it likely to be a proxy for international influences. All tables report the log likelihoods and pseudo-R^2 measures for corresponding regressions. As discussed in more detail in Appendix III, log likelihood is proportional to the badness of fit in logit models, while pseudo R^2 is synonymous with the regular linear regression coefficient of determination. All regressions were significant at 95% confidence level.

As predicted, the terms of trade variable has a negative coefficient, which suggests that the improvement of a country's terms of trade will increase the probability of its exchange rate regime remaining fixed or being a forward-looking crawl or band. The foreign liabilities variable is positive, which, again, indicates that an increase in foreign liabilities increases the probability that a country will adopt a more competitive exchange rate regime, thereby ensuring enough revenues generated by exports to repay its debt to foreign investors. Similarly, debt in major foreign currencies is consistently significant and positive. The positive sign indicates that countries with large amounts of foreign currency-denominated debt are also more likely to adopt a more competitive exchange rate regime. The current account restriction variable has a positive coefficient, the opposite of what was expected. This suggests that countries with current account restrictions are likely to adopt more competitive exchange rate regimes. A possible explanation for this is that countries with current account restrictions are more able to protect against instability in their floating exchange rate and are thus more able to maintain flexible exchange rates. The external account balance is positive, but it not significant. In a separate set of regressions, the external account balance variable was consistently significant when the foreign liabilities variable was excluded from the model.

The new external/interaction variables are consistently significant across the variants estimated in Table 1. Their coefficients, as expected, do not change measurably with the changed specification. It is of interest, however, that the estimates in column 2 differ little from the other regressions in the table, suggesting that external variables have had the same impact on choice of exchange rate regime both prior to and after the collapse of the Bretton Woods system.

The overall equation provides a better fit of the data than the original FGS model, with a

much lower badness of fit statistic and a slightly improved pseudo-R^2. Table 2 estimates the regression in column 1 using all of the external/interaction variables, those in the FGS article as well as the new variables we have introduced.

(INSERT TABLE 2 ABOUT HERE)

The badness of fit statistic once again improves, though the pseudo R^2 is lower. The signs and significance of the variables are comparable to that of Table 1 and to the original FGS estimates. Reserve ratio and capital controls variables are not significant in any of the regressions. The one change is the decline in the importance of current account restrictions, which is no longer statistically significant, in contrast to the FGS estimates.

With the importance of the new external/interaction variables as exchange rate regime determinants established, the next step is to determine if they will retain their significance when added to the FGS model and whether they improve the fit of that model. Table 3 presents the complete model, with the new external/interaction factors added to the FGS regressions.

(INSERT TABLE 3 ABOUT HERE)

Terms of trade, foreign liabilities, debt in major foreign currencies, and current account restriction variables are statistically significant.[2] All of the coefficients for external/interaction variables also retained their approximate values and original signs from the tables where they were the only independent variables. This result demonstrates that the variables are robust to additions of other non-external variables. In addition, the regression with the variables added to the basic FGS model has lower log likelihoods and higher pseudo R^2 measures than the ones presented in the FGS article. This indicates that the added external variables reduce the badness of fit and improve the explanatory value of the basic FGS model. This reinforces the importance

of including external/interaction variables in models aimed at determining exchange rate policy in Latin America.[3]

An important point from the results of the regressions, and related to the objective of this paper, is that the model with combined internal and external factors provides the best statistical results. By comparing the log likelihood ratios and pseudo R^2 measures in Table 1, the model with external variables only with the internally focused FGS model, to the results in Table 3, which contains the combination of the previous two, the model with combined internal and external/interaction factors produces the lowest log likelihoods and the highest coefficients of determination. In other words, the model has higher explanatory value than the other two. So the model that best determines the choice of the exchange rate regimes in Latin American economies should contain a combination of internal, external and interaction economic variables to allow the most complete understanding of this very important choice.

V. Conclusions

This paper explored the importance of the external and interaction economic variables as determinants of Latin American exchange rate policy. The paper provided the justification for the emphasis of these variables by providing examples of how histories of Latin American countries' exchange rate policies have been determined in good part by international factors. It also established the statistical significance of the external factors. Terms of trade, foreign liabilities, debt in major foreign currencies, and restrictions of current account variables were all significant in determination of the choice of exchange rate regimes in Latin America.

Finally, the paper combined the internal, external and interaction factors into one model

and demonstrated how it produced results better than the ones obtained in models with only internal factors or only external factors. The comparison was done by comparing the explanatory values of different models, focusing on log likelihoods and pseudo coefficients of determination.

TABLE 1

Sensitivity Analysis of Model with External Variables Only

	(1) REGIME	(2) REGIME (1973-1994)	(3) REGIME2 (Excluding adjustable pegs)	(4) REGIME3 (forward looking before fixed)
Open	-2.46 (-5.40)	-3.39 (-7.38)	-2.68 (-5.74)	-0.97 (-3.52)
Terms of Trade	-0.0177 (-4.14)	-0.021 (-4.28)	-0.017 (-3.82)	-0.0095 (-2.99)
Foreign Liabilities	4.96e-15 (3.92)	4.77e-15 (3.85)	4.86e-15 (3.87)	4.17e-15 (3.64)
Current Acct. Restriction	0.58 (2.52)	0.50 (2.25)	0.64 (2.80)	0.68 (3.17)
External Account Balance	2.00e-13 (0.43)	4.08e-13 (0.79)	1.47e-13 (0.30)	4.36e-13 (1.00)
Debt in major foreign currencies	2.89e-11 (4.61)		2.77e-11 (4.35)	2.90e-11 (4.66)
N	500	460	480	500
Log Likelihood	-389.76	-380.13	-380.38	-423.29
Pseudo R^2	0.204	0.1797	0.209	0.136

TABLE 2
All External/interactive Variables

Variable	Regime - Stein definition
Volatility	-5.85 (-2.4)
Tariff	.737 (2.58)
Openness	-1.42 (-2.16)
Reserves/M2	.378 (.558)
Capital Controls	.15 (.445)
Terms of Trade	-.0165 (-3.41)
Foreign Liability	3.71e-15 (3.1)
Curr Acct Restr	.41 (1.3)
External Bal	3.51e-13 (.69)
Debt	2.55e-11 (3.563)
N	389
Log Likelihood	-344.36
Pseudo R^2	.1951

TABLE 3
All Variables

Variable	Regime - Stein definition
Volatility	-6.28 (-2.14)
Tariff	.56 (1.58)
Openness	-.54 (-.53)
Reserves/M2	.144 (.145)
Capital Controls	-.53 (-1.18)
Terms of Trade	-.025 (-3.39)
Foreign Liability	7.97e-15 (2.89)
Curr Acct Restr	.77 (1.9)
External Balance	-5.02e-13 (-.66)
Debt	3.94e-11 (4.06)
Log Inflation	.096 (.387)
Hyperinflation	-1.67 (-2.06)
Manugdpl	6.46 (1.62)
Pol Instability	-.18 (-.292)
Govt Seats	-4.56 (-2.63)
Efpart	-.78 (-3.82)
N	267
Log Likelihood	-233.98
Pseudo R^2	.2313

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APPENDIX I

COMPARISON OF REGIME CATEGORIZATIONS: FRIEDEN, GHEZZI AND STEIN VS. LEVY AND STURZENEGGER

In their comprehensive exchange rate regimes study of 147 countries, Levy and Sturzenegger (2002) use a 5-way classification of exchange rate regimes as follows:

1 = Inconclusive

2 = Float

3 = Dirty

4 = Dirty/crawling peg

5 = Fix.

They also simplify the above classification by reducing it to three distinct levels:

1 = Float

2 = Intermediate (dirty; dirty/crawling peg)

3 = Fix.

In order to obtain valid correlation coefficient between this 3-way classification and Stein's classification, we transformed Stein's four categories in the following manner:

Stein's original classification	**Changed to**	**Stein's modified classification**
0 = fixed (to single currency, basked, or infrequent adjustments)	→	3 = fixed
1 = forward-looking crawls and bands	→	2 = intermediate
2 = floating (managed or independent)	→	1 = float
3 = backward-looking crawl or band	→	2 = intermediate

Assuming the changes above, we obtained correlation coefficient, Δ*, of .54 between Stein's and Sturtz's classifications of exchange rate regimes.

In order to further explore sensitivity analysis of exchange rate regime classification, we compared logit regression result with Stein's basic domestic variables and his definition of the dependent variable to the one with same independent variables, but Sturzenneger's classification of the dependent variable. For this, we transformed both Stein's and Sturtz's catogorizations into a "0 – 2" category system, where 0 represents fixed exchange rate regime and is used as the baseline value, against which all others are evaluated. Table below summarizes the transformation process:

Stein Original	**Changed to**	**"0-2" Classification**	**Changed to**	**Sturz's 3 way classification**
0 = fixed	→	0 = fixed	←	3 = Fix
1 = forward-looking crawls and bands	→	1 = intermediate	←	2 = Intermediate (dirty; dirty/ crawling peg)
2 = floating (managed or independent)	→	2 = floating	←	1 = Float
3 = backward-looking crawl or band	→	1 = intermediate		

Only observations after 1973 were included in regressions, because Sturzenegger's study covers only years 1974 and forward. Logit regression results are shown below:

* Δ = cov(STEIN,STURTZ)/ Φ(STEIN)*Φ(STURTZ) = .54

	Original Stein's "0-3" classification	Stein's converted into "0-2" classification	Sturtz's coverted into "0-2" classification
Log Inflation	.153 (.697)	.4 (1.56)	-.16 (-.75)
Hyper	-1.75 (-2.36)	-1.54 (-1.88)	2.7 (2.15)
Open	-2.76 (-4.88)	-1.68 (-3.24)	-2.26 (-4.4)
Manugdpl	9.14 (2.92)	5.6 (1.73)	2.61 (.84)
Polins	-1.19 (-2.04)	-1.25 (-2.14)	.17 (.34)
Govseats	-3.88 (-4.05)	-3.9 (-3.8)	-4.35 (-4.4)
Efpart	-0.27 (-2.09)	.019 (.142)	-.084 (-.612)
N	363	363	349
Log Likelihood	-323.35	-282.68	-282.51
Pseudo R^2	0.1552	0.1645	0.1761

Three independent variables: log inflation, hyperinflation, and political instability, all changed signs when Sturtz's "0-2" categorization was used rather than either Stein classification system. Again there is less than perfect correlation between Stein's and Sturtz's classifications of exchange rate regimes. This indicates the importance of the definition of exchange rate regime.

APPENDIX II
DESCRIPTIVE STATISTICS FOR ADDED EXTERNAL AND INTERACTION VARIABLES

Descriptive Statistics for all Interaction/External Variables

Variable	# of obs	Mean	Std. Dev.	Min.	Max.
Volatility	786	.0821596	.0864097	.0049319	.4753268
Tariff	645	.1844961	.3881893	0	1
Openness	836	.6372083	.4051915	.082722	2.498747
Reserves/M2	834	.2395633	.204609	.0004212	1.552833
Capital Controls	721	.7170596	.4507404	0	1
Terms of Trade	811	123.3909	40.81798	30	359
Foreign Liability	747	3.39e+13	1.81e+14	3.27e-06	1.72e+15
Curr Acct Restr	724	.538674	.4988467	0	1
Bal_1l	811	-2.31e+10	2.28e+11	-1.27e+12	1.56e+12
External Balance	836	-2.58e+10	2.47e+11	-2.24e+12	1.56e+12
Debt	585	7.81e+09	1.74e+10	4075200	9.87e+10

Mean of all Interaction/External Variables Under Different Exchange Rate Regimes

Variable	Fixed	Forward Looking	Flexible	Backward Looking
Volatil	.0902165	.08238	.07564	.04238
Tariff	.0604651	.5172	.5862	.2727
Openness	.699576	.4762	.5503	.38
Res/M2	.2262	.2164	.2658	.3084
Cap Con	.6935	.6207	.6309	.9394
ToT	127	112.8	110.90	113.73
For Liab	2.76e+12	4.54e+14	3.70e+13	2.04e+14
Curr Res	.5058	.3448	.3809	.8989
Bal_1l	-3.44e+10	-2.90e+10	-5.61e+09	2.98e+10
Ext Bal	-3.37e+10	6.42e+09	-2.25e+10	1.05e+10
Debt	2.86e+09	1.63e+10	1.15e+10	2.18e+10

Appendix III
Logit Model

Logit models are used when the dependent variable has a discrete number of response levels. The parameters are estimated using the method of Maximum Likelihood Estimation (MLE), which is concerned with picking parameter estimates that result in the highest probability of having obtained the observed sample Y (Aldrich & Nelson, 1984). Logit parameter estimates for independent variables represent the impacts of the changes in the variables on the probability of a certain dependent variable response level occurring over the reference response level. An equation for a simple binomial logit model, where the dependent variable has only two response levels, 0 and 1, has the form:

$$\ln[P_i/(1-P_i)]= \alpha + \beta_1 X_{1i} + \beta_2 X_{2i} + 0_i,$$

where the left-hand variable represents the natural log of the probability that the state described by P_i will occur over the state described by $1-P_i$. We can see that the increases in the values of the parameters β_1 and β_2 increase the value of $\ln[P_i/(1-P_i)]$, which implies the higher probability described by P_i. If we wanted to derive the explicit formula for P_i, it would take the form:

$$P_i = 1/[1+e^{-(\alpha + \beta_1 X_{1i} + \beta_2 X_{2i} + 0_i)}],$$

which shows us that the equation limits the dependent variable output to the values between 0 and 1, regardless of how large or small the values of the independent variables are since:

$$\text{the limit as } 1+e^{-(\alpha + \beta_1 X_{1i} + \beta_2 X_{2i} + 0_i)}64 \text{ of } P_i = 1,$$

and the limit as $1+e^{-(\alpha + \beta_1 X_{1i} + \beta_2 X_{2i} + 0_i)}$6-4 of $P_i = 0$ (Studenmund, 2001).

Similarly, the same method is used in the case when the dependent variable has more than two discrete response levels. If there are N number of dependant variable response levels, a series of N-1 binomial logit equations are created. This type of model is named multinomial logit. One response level is used as a baseline value that remains in the denominator of the left side of the equation. All obtained equations can be combined into one under the assumptions that the impacts of parameter estimates are independent of the dependent variable response level values, and that they are invariant to the choice of the cutoff point α_i.

More specific type of multinomial logit model, multinomial ordered logit, is used when the response levels for the dependent variable are ordered. There are several ways to build this model. In this section, I will only introduce the cumulative logits method. For alternative methods, see Agresti (1990). Cumulative logits method estimates the probability that a case will fall in the category j or lower, as opposed to category j + 1 or higher (DeMaris, 1992). If $O\#_j$ is the j-th cumulative odds, and π_j is the probability of obtaining a response level in category j, than the model will take have the form:

$$\ln[(\pi_1+\pi_2+ \ldots +\pi_j)/(\pi_{j+1} + \ldots +\pi_J)] = \ln(O\#_j) = \alpha + \beta_1 X_{1i} + \beta_2 X_{2i} + 0_i \text{ (DeMaris, 1992)}$$

We can see that the logits keep accumulating until the $J-1$ logit. The J logit will always remain in the denominator of the left-hand side variable as an extreme dependent variable response level. Throughout the regressions in this paper, the extreme dependent variable response level of 0, representing the fixed exchange rate regime, is used as a baseline value.

Two measures used to demonstrate any changes in the statistical values of the logit models are G^2 and pseudo R^2. G^2 is the deviance of the model and has a form:

$$G^2 = -2\ln L,$$

where lnL is the model=s log likelihood. It follows from this that the log likelihood is directly related to the deviance of the model. As the model=s explanatory value increases, log likelihood decreases thereby lowering the G^2 measure. G^2 is often used as analogous to the residual sum of squares (DeMaris, 1992). If we know the deviance of the model we can use it to approximate the coefficient of determination, or R^2. It is given by:

$$R^2=[(G_0^2 - G_1^2)/G_0^2] = 1- (G_1^2/G_0^2),$$

where G_1^2 represents th deviance of a model with variables, and G_0^2 is the deviance of the null model, with only the intercept terms. This pseudo-R^2 can be thought of as the proportion of deviance explained (DeMaris, 1992).

Lastly, maximum likelihood analysis is unique in that it follows asymptotic normal probability distribution. The probability distribution is fully formed only if the number of observations is high enough to allow for this property. There is no specific rule of thumb how high the number of observations should be. However, as mentioned in earlier in the paper, it is recommended that one has at least 15 observations per independent variable for a reliable analysis.

[1] The variables, their measurement, and their expected effect on the choice of exchange rate regime is specified in detail in Frieden, Ghezzi and Stein 2000). The interested reader is referred to that source for more extensive treatment of the variables.

[2] There might be some question about the statistical significance of the results obtained in Table 3 because of the low number of observations relative to the results in the FGS model. Since there are no firm guidelines regarding the number of observations in logit modeling, the same rule of thumb that is used in ordinary least squares analysis can be used for multinomial logit (Demaris 1992). The rule states that there should be at least 15 observations per explanatory variable in order for the results to be reliable. The regression in Table 3 follows this guideline.

[3] In a separate set of regressions, not shown in this paper, external account balance along with the current account restriction variables were consistently significant when other external variables were not included in the regressions. Given the choices between the model with these two variables or the model already present in this paper, we report the results in the latter model because it better captures the external macroeconomic influences. Also, when time trend is included in regressions, debt in major foreign currencies variable loses its statistical significance, with log likelihoods and pseudo R^2 measures remaining approximately the same throughout the regressions.